Forest Health Protection
Pacific Southwest Region

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To: District Ranger, Devils Garden Ranger District, Modoc National Forest

Subject: Evaluation of pine engraver beetle (*Ips pini*) activity in the Bluebird Mechanical Thinning Project (FHP Report NE10-01)

At the request of Anne Mileck, silviculturist for the Devils Garden Ranger District, I conducted a field evaluation of the Bluebird Mechanical Thinning Project on October 8, 2009. The objective of the visit was to evaluate a recent pine engraver beetle (*Ips pini*) outbreak, which caused significant top kill and whole tree mortality of ponderosa and Jeffrey pine, and provide management recommendations as appropriate. Anne Mileck and Bill Reading accompanied me in the field.

Background

The project area is located on the lower east side of Blue Mountain about 25 miles northwest of Alturas, CA at an elevation of approximately 5,100 feet. Precipitation for the site averages between 15 - 20 inches per year. Stands are dominated by 8 to 18" diameter Jeffrey pine (*Pinus jeffreyi*) and ponderosa pine (*Pinus ponderosa*) with scattered western juniper (*Juniperus occidentalis*). Harvesting with a feller/buncher began in the fall of 2008 leaving green trees stacked in bundles, or doodles, consisting of larger diameter stems (up to 14"), throughout a 37 acre unit before cutting ceased for the winter. Harvesting resumed in July 2009 creating additional green tree doodle piles in an adjoining 89 acre area.

Observations

Pine engraver beetles have successfully attacked approximately 600 standing trees within the two units resulting in top kill and whole tree mortality (Figure 1). The timing of these attacks appears to coincide with the July 2009 tree cutting as all doodle piles created at this time were also completely colonized (Figure 2).

NORTHEASTERN CALIFORNIA SHARED SERVICE AREA
2550 RIVERSIDE DRIVE
SUSANVILLE, CA 96130
530-257-2151

Daniel Cluck
Entomologist
dcluck@fs.fed.us

Amanda Garcia-Grady
Entomologist
amandagarcia@fs.fed.us

Bill Woodruff
Plant Pathologist
wwoodruff@fs.fed.us

Figure 1. Top-kill and whole tree mortality caused by *Ips pini*.

Figure 2. Doodle piles consisting of larger diameter (up to 14") stems

Pine engravers have emerged from nearly all doodle piles in units 51341 and 51342 (Figure 3). Beetle status in attacked trees was not determined since most activity was too high on the boles to sample. Lower boles of pine engraver attacked trees had scattered pitch streamers from woodborer (Families: Cerambycidae and Buprestidae) attacks.

Pine engravers were also found in doodle piles that were created from late July to October of this year in another treatment area (unit 62504). The number of galleries found in this material was fewer than in piles from the units with tree mortality due to competition from woodboring beetles and possibly lower pine engraver populations due to the lack of previously created brood material within the stand. Many of these piles were also created after beetle activity declined for the season.

Discussion

Pine engraver beetles are typically a slash breeding insect that only infest living trees if they are diseased, damaged or drought stressed (Appendix A). However, creating large quantities of green pine slash can lead to subsequent tree mortality in two ways; providing brood material that results in a build up in pine engraver numbers that subsequently emerge and attack adjacent pine trees or by attracting beetles to trees that are in close proximity to the green slash. The risk of tree mortality associated with green slash increases during drought periods when trees are under moisture stress.

Historically, northeastern California has experienced very little tree mortality caused by the pine engraver. For example, since 1924 there have been only 13 documented outbreaks of *Ips pini* in the 1.3 million acres of eastside pine (Schultz 1999) and not all of these were associated with logging activity or covered significant acreages. In 2001, significant tree mortality caused by *Ips pini* was documented on the Plumas and Modoc National Forests (Forest Pest Conditions in California – 2001), associated with an extremely dry year, in eastside pine stands that were growing at the edge of their range. Many of these stands were also overstocked, infected with western dwarf mistletoe (*Arceuthobium campylopodum*) and/or blackstain root disease (*Leptographium wageneri*) that created additional stress on individual trees.

Past observations of Ips caused tree mortality associated with harvest activities in California reveal that leaving green material on the ground or in piles, distributed throughout treatment areas, creates a greater risk of subsequent tree mortality than consolidating green material at landings. Most of these observations pertain to the California fivespined ips (*Ips paraconfusus*) which primarily occurs on the west side of the Sierra and Cascade crest. *Ips pini* caused tree mortality on the eastside has been associated with drought years more often than with green pine slash. However, most significant outbreaks were triggered by a combination of both factors.

Several factors appear to be responsible for the pine engraver caused tree mortality within the Bluebird thinning project. First, the pine trees making up the doodle piles consist of larger diameter stems (up to 14" DBH). This is larger material than most previous pre-commercial thinning operations have created on the Modoc National Forest. Consequently, these trees did not sufficiently dry out from the time they were cut (September 2008) until the first beetle flight the following spring (approximately late April/May 2009). Second, these larger trees also provided a tremendous amount of brood material for pine engraver beetles to successfully reproduce in. Third, the timing of the continuation of thinning treatments in the adjacent unit

(July 2009) created more green tree doodle piles as pine engraver beetles were emerging from the 2008 piles. This new material concentrated large numbers of emerging beetles into the adjacent stand, attacking new piles and adjacent residual trees. Other factors that may have contributed to this event are the relatively cool spring that may have kept green tree piles from drying out before beetle flight and the current drought that is occurring in the area. The fact that so many residual trees were successfully attacked and killed by pine engraver beetles indicates the high level of drought stress that they are experiencing.

Tree mortality in units 51341 and 51342 will not likely continue in 2010 except for additional fading of green trees already infested with pine engraver beetles. Ips outbreaks are generally short-term events and seldom last for more than one or two years. However, if dry conditions persist, there could be more successful attacks in these stands in 2010.

There is also a possibility of tree mortality in unit 62504 where green doodle piles have been recently created within the stand, especially if more green piles are created next summer in adjacent areas.

Treatment Alternatives:

Continue harvesting and removing trees as scheduled:

Unit 62504 – (This alternative assumes tree harvesting continues for the rest of 2009, begins again in July 2010 in the adjacent areas, and all material is left on the ground to dry; some piles remaining until 2011) The result of this alternative will be a high risk of having more trees killed in 2010 due to pine engraver beetles building up their numbers in the green doodle piles created this fall, concentrating on newly created piles next summer in adjacent areas and spilling over and attacking residual trees. Mortality levels will likely be unacceptable for management objectives.

Units 51341 and 51342 – (Piles are left to dry and pine engraver beetle infested trees are not removed.) The result will be the possibility of additional tree mortality if drought conditions persist.

Discontinue harvest and remove all material immediately:

Unit 62504 - This alternative effectively reduces the risk of additional pine engraver beetle caused mortality to very low levels as all currently infested and uninfested brood material would be eliminated from the stands and no new material would be created. However, this alternative also creates a problem with the economics of the treatment as the loss in cost effectiveness of having to haul wet chips hinders the Forest's ability to complete the project.

Units 51341 and 51342 – The same economic problem with removing wet chips exists in these units. Furthermore, the probability of additional mortality would not change significantly with the prompt removal of this material. Pine engravers have mostly emerged from doodle piles in these units and have likely emerged from all pines with faded crowns. Removal of green infested trees could possibly reduce beetle numbers in the stand but an additional visit in the spring of 2010 would be required to determine the number of infested trees and assess whether or not timely removal would be worth the effort.

Discontinue harvest for the remainder of 2009 and resume in 2010 at a later date in areas that are away from existing doodle piles:

Unit 62504 – This alternative accepts a higher level of risk of future pine engraver beetle caused mortality by allowing doodle piles to dry on site but allows the project to continue, eventually thinning and removing all material by the end of 2011. Existing doodle piles in this unit do not appear to be infested by high numbers of pine engraver beetles and some are currently uninfested. However, much of this material will remain suitable when beetles begin to fly in April/May 2010 and present a risk to adjacent trees. The key to success in this alternative is to not create additional green piles later in the summer in adjacent areas and set up the same scenario that created the current pine engraver outbreak. Instead, harvest activity would resume later in the year, in August 2010, in areas that are the greatest distance from existing piles (approximately one mile away). Doodle piles created at this time should be placed as far away from adjacent pines as possible. This strategy will attempt to avoid concentrating large numbers of emerging beetles on new piles and preventing spillover attacks on adjacent trees. Material created after August 2010 could be left on site until dry in 2011.

Units 51341 and 51342 – All harvesting has been completed. The risk of leaving doodle piles and infested trees until the end of 2010 or 2011 is discussed in the first alternative.

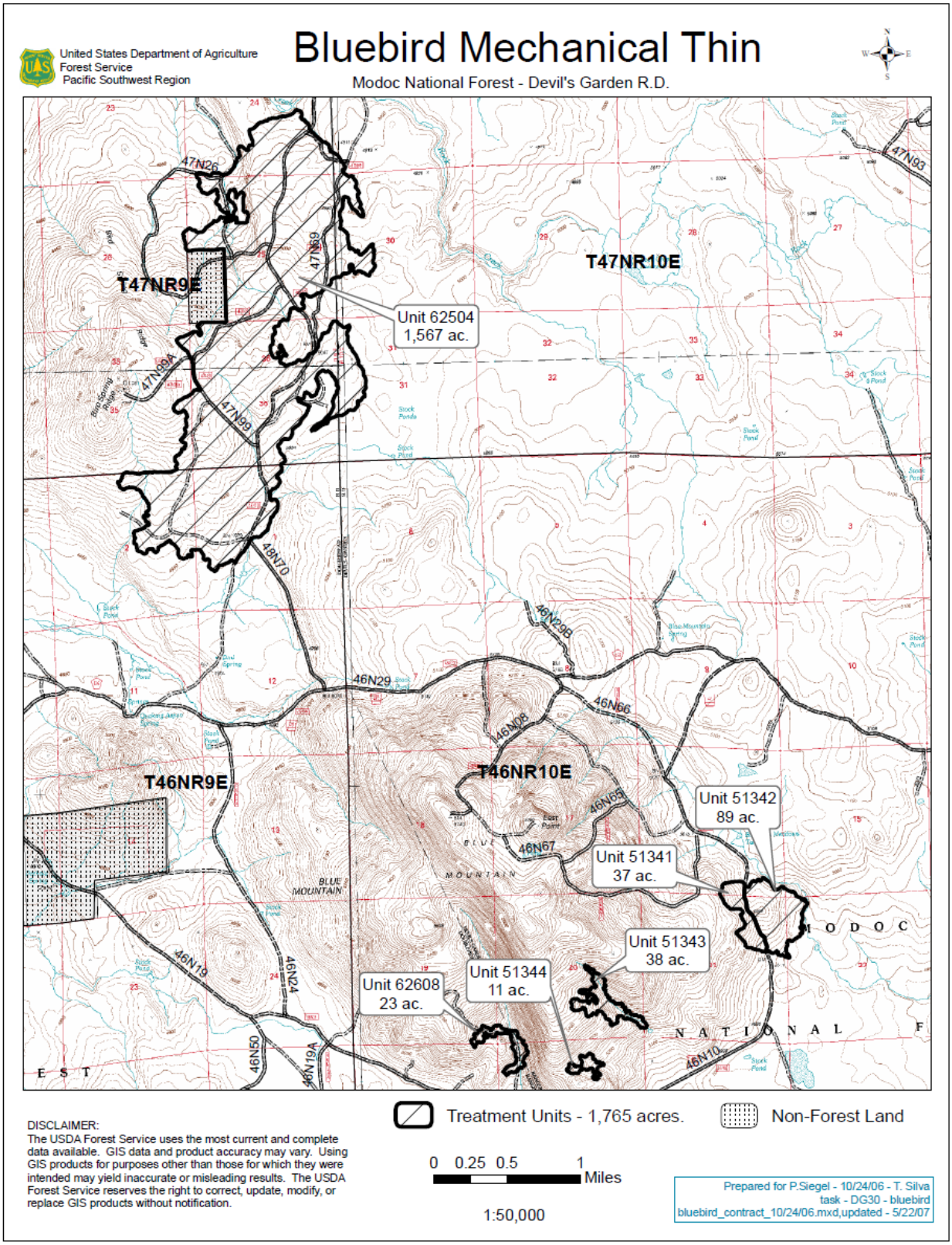
If you have any questions regarding this report and/or need additional information please contact me at 530-252-6431 or dcluck@fs.fed.us.

/s/ Danny Cluck

Daniel R. Cluck
Entomologist
NE CA Shared Services Area

cc: Anne Mileck, Devils Garden RD
Bill Reading, Devils Garden RD
Bill Schoeppach, Modoc SO
Forest Health Protection, Regional Office

Figure 3. Bluebird treatment units



Appendix A: *Ips* Bark Beetles

Ips spp. attacks have been recorded on most species of pines in California. These beetles kill saplings, poles and sawtimber up to about 26 inches dbh and the tops of even larger trees. Attacks on live trees are usually limited to trees which are suppressed, or stressed by dwarf mistletoe, root disease, drought, fire or the attack of other insects. If fresh slash is available in the spring, pine engravers may build up in an area and cause localized mortality or top killing by mid-summer.

Attacks are made with the coming of warm weather in the spring. Attacking males bore nuptial chambers in the inner bark and release a pheromone which attracts other beetles to the attack site. If many beetles are attracted, they may attack nearby trees and cause a group kill. Within a day or two of the attack by the male, two to five females enter the nuptial chamber and after mating, each female bores an individual egg gallery which lightly scores the sapwood. The size and pattern of the combined gallery pattern is often diagnostic of the species of Ips involved. The galleries are kept open by beetles pushing boring dust out through the entrance hole. Red boring dust collecting in bark crevices or spider webs is diagnostic of a successful attack. Eggs are laid in niches along the sides of the galleries. Larvae hatch from the eggs and feed in the phloem. They eventually pupate in cells at the end of their larval mines and transform to adults.

A new generation is produced in as little as 6-8 weeks in the spring to 4-6 weeks in mid-summer (August). Thus, several overlapping generations per year may be produced. The winter may be passed in any of the life stages of larvae, pupae, or adults, depending upon which *Ips* species is involved.

Outbreaks in standing, healthy trees are sporadic and of short duration, and are often associated with some temporary stress or shock afflicting the host species, such as drought or logging disturbance. Tree killing frequently occurs where green pine slash, which serves as breeding habitat is left untreated during spring and summer. To be suitable as *Ips* breeding habitat, pine slash must have bark from 1/8 to 1 inch thick (usually 3 to 26 inches diameter), must have succulent cambium and must remain moderately cool during the development period.

Fresh pine slash caused by thinning, dwarf mistletoe control work, construction or winter storm breakage can be modified in a number of ways to make it unsuitable for *Ips* breeding. One approach to minimizing damage is to schedule slash-generating activities mostly between mid-July and late-December, when the slash has a high probability of drying out, heating up, or spoiling before the beetles can complete their development. Utilization of the cut material to the smallest possible diameter will minimize the amount of breeding material available to *Ips* beetles. If green pine slash must be created during the spring and early summer, slash treatments are available to prevent the buildup of pine engraver populations. Because *Ips* beetles can complete their development in about a month under ideal conditions, treatment should be carried out soon after cutting to be effective.

Slash treatment methods which generally work well include chipping, lopping and scattering slash in sunny areas to heat it up, crushing or mashing slash with logging equipment to make it unsuitable for *Ips* breeding, or piling and burning the slash within a month of cutting. Broadcast burning the slash might work if it could be done without damaging the residual stand. A method which has worked during the summer in hot climates is to pile slash in a sunny area and tightly cover the pile with clear plastic. If the temperature under the bark of slash in all parts of the pile

reaches 120^{o}F, all brood currently in the pile will be killed. Lower temperatures will not be effective and, where successful, this method will not prevent reinfestation of slash piles. Because most *Ips* attacks occur within a quarter-mile from the location where the beetles emerged, high value pines can be given some protection by removing fresh pine slash to areas which do not have pines.

Two practices which should generally be avoided are piling fresh pine slash without further treatment, and allowing slash to touch or remain near valuable leave trees.